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L6: Entry 2 of 8

File: PGPB

Apr 7, 2005

DOCUMENT-IDENTIFIER: US 20050073396 A1
TITLE: MULTIPURPOSE VISION SENSOR SYSTEM

Abstract Paragraph:

A multipurpose sensing system (10) for a vehicle (12) includes an optic (14) that is directed at multiple viewing areas (18). A vision sensor (16) is coupled to the optic (14) and generates multiple object detection signals corresponding to the viewing areas (18). A controller (22) is coupled to the vision sensor (16) and generates multiple safety system signals in response to the object detection signals.

Application Filing Date:

20031002

Summary of Invention Paragraph:

[0001] The present invention relates to vehicle sensing systems. More particularly, the present invention relates to a method and system for performing multiple sensing system operations utilizing a single vision sensor.

Summary of Invention Paragraph:

[0010] The present invention provides a method and system for performing multiple sensing system tasks or operations. A multipurpose sensing system for a vehicle is provided and includes an optic that is directed at multiple viewing areas. A vision sensor is coupled to the optic and generates multiple object detection signals corresponding to the viewing areas. A controller is coupled to the vision sensor and generates multiple safety system signals in response to the object detection signals.

Detail Description Paragraph:

[0040] The indicator 26 is used to signal or indicate a safety system signal, which may include a warning signal, a collision-warning signal, a countermeasure signal, or an object identification signal in response to the object detection signals. The indicator 26 may include a video system, an audio system, an LED, a light, a global positioning system, a heads-up display, a headlight, a taillight, a display system, a telematic system, or other indicator known in the art. The indicator 26 may supply warning signals, collision-related information, lane departure and lane-keeping information, external-warning signals to objects or pedestrians located outside of the vehicle 12, or other pre and post collision information.

Detail Description Paragraph:

[0050] In step 106, the controller 22 generates multiple safety system signals in response to the object detection signals. The safety system signals may include not only countermeasures related signals, as stated above, but may also include signals related to other sensing system controls, some of which are also stated above.

Detail Description Paragraph:

[0051] In step 108, the controller 22 may determine occupant characteristics in response to the object detection signals. In determining occupant characteristics the controller 22 may also determine whether a child safety seat is located within a vehicle seat of the viewing area 60". Step 108 may be performed simultaneously

with step 106, whereby, the controller 22 generates or modifies safety system signals in response to the determined occupant characteristics.

Detail Description Paragraph:

[0052] In step 110, the controller 22 may perform multiple sensing system operations in response to the safety system signals. The controller 22 may perform a countermeasure operation, a windshield clearing operation, an adaptive cruise control operation, or any of the other above-mentioned or known in the art sensing system operation in response to the safety system signals. For example, the vision sensor 16 may detect a moisture level on the windshield 32 to be above a predetermined level and in response thereto the controller 22 may activate or increase speed of the wiper system 34. As another example, the vision sensor 16 may detect an occupant that is small in size or a child safety seat within a seat system and decelerate or prevent activation of an air bag near the occupant or safety seat.

Detail Description Paragraph:

[0054] The present invention provides a multipurpose sensing system that is capable of monitoring multiple viewing areas using a single vision sensor and controller. The present invention in utilizing a single vision sensor and controller minimizes the number of sensors and sensing system components within a vehicle, sensing system complexity, and manufacturing and maintenance costs involved therein.

CLAIMS:

1. A multipurpose sensing system for a vehicle comprising: at least one optic directed at a plurality of viewing areas; a single vision sensor coupled to said at least one optic and generating a plurality of object detection signals corresponding to said plurality of viewing areas; and a controller coupled to said vision sensor and generating a plurality of safety system signals in response to said plurality of object detection signals.

2. A system as in claim 1 wherein said vision sensor generates a first object detection signal and a second object detection signal and wherein said controller generates a first safety system signal in response to said first object detection signal and a second safety system signal in response to said second object detection signal.

16. A method of performing a plurality of sensing system operations within a vehicle comprising: monitoring a plurality of viewing areas; generating a plurality of object detection signals from a single vision sensor corresponding to said plurality of viewing areas; generating a plurality of safety system signals in response to said plurality of object detection signals; and performing the plurality of sensing system operations in response to said plurality of safety system signals.

20. A multipurpose sensing system for a vehicle comprising: a multi-focal lens having a first focal point corresponding to a first viewing area and a second focal point corresponding to a second viewing area; a reflective device directed at said second viewing area; a vision sensor coupled to said bi-focal lens and generating a first object detection signal with respect to said first viewing area and a second object detection signal with respect to said second viewing area as is reflected from said reflective device; and a controller coupled to said vision sensor and generating a first safety system signal in response to said first object detection signal and a second safety system signal in response to said second object detection signal.

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☐ 1. Document ID: US 20050137774 A1

L6: Entry 1 of 8

File: PGPB

Jun 23, 2005

PGPUB-DOCUMENT-NUMBER: 20050137774

PGPUB-FILING-TYPE: new

DOCUMENT-IDENTIFIER: US 20050137774 A1TITLE: SINGLE VISION SENSOR OBJECT DETECTION SYSTEM

PUBLICATION-DATE: June 23, 2005

INVENTOR-INFORMATION:

NAME	CITY	STATE	COUNTRY
Rupp, Jeffrey D.	Ann Arbor	MI	US

US-CL-CURRENT: 701/96; 180/170, 340/436

Full	Title	Citation	Front	Review	Classification	Date	Reference	Sequences	Attachments	Claims	KIMC	Drawn De
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☐ 2. Document ID: US 20050073396 A1

L6: Entry 2 of 8

File: PGPB

Apr 7, 2005

PGPUB-DOCUMENT-NUMBER: 20050073396

PGPUB-FILING-TYPE: new

DOCUMENT-IDENTIFIER: US 20050073396 A1

TITLE: MULTIPURPOSE VISION SENSOR SYSTEM

PUBLICATION-DATE: April 7, 2005

INVENTOR-INFORMATION:

NAME	CITY	STATE	COUNTRY
Mills, Aaron L.	Ann Arbor	MI	US
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US-CL-CURRENT: 340/435; 701/45

Full	Title	Citation	Front	Review	Classification	Date	Reference	Sequences	Attachments	Claims	KIMC	Drawn De
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☐ 3. Document ID: US 20050017857 A1

L6: Entry 3 of 8

File: PGPB

Jan 27, 2005

PGPUB-DOCUMENT-NUMBER: 20050017857
PGPUB-FILING-TYPE: new
DOCUMENT-IDENTIFIER: US 20050017857 A1

TITLE: VISION-BASED METHOD AND SYSTEM FOR AUTOMOTIVE PARKING AID, REVERSING AID,
AND PRE-COLLISION SENSING APPLICATION

PUBLICATION-DATE: January 27, 2005

INVENTOR-INFORMATION:

NAME	CITY	STATE	COUNTRY
Rao, Manoharprasad K.	Novi	MI	US
Prakah-Asante, Kwaku O.	Commerce Township	MI	US
Strumolo, Gary Steven	Beverly Hills	MI	US
Ebenstein, Samuel Edward	Southfield	MI	US
Smith, Gregory H.	Ann Arbor	MI	US

US-CL-CURRENT: 340/435

Full	Title	Citation	Front	Review	Classification	Date	Reference	Sequences	Attachments	Claims	KWIC	Draw. De
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☐ 4. Document ID: US 7158015 B2

L6: Entry 4 of 8

File: USPT

Jan 2, 2007

US-PAT-NO: 7158015
DOCUMENT-IDENTIFIER: US 7158015 B2

TITLE: Vision-based method and system for automotive parking aid, reversing aid,
and pre-collision sensing application

PRIOR-PUBLICATION:

DOC-ID	DATE
US 20050017857 A1	January 27, 2005

Full	Title	Citation	Front	Review	Classification	Date	Reference	Sequences	Attachments	Claims	KWIC	Draw. De
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☐ 5. Document ID: US 6958683 B2

L6: Entry 5 of 8

File: USPT

Oct 25, 2005

US-PAT-NO: 6958683
DOCUMENT-IDENTIFIER: US 6958683 B2

TITLE: Multipurpose vision sensor system

Full	Title	Citation	Front	Review	Classification	Date	Reference	Sequences	Attachments	Claims	KWIC	Draw. De
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☐ 6. Document ID: US 4790225 A

L6: Entry 6 of 8

File: USPT

Dec 13, 1988

US-PAT-NO: 4790225

DOCUMENT-IDENTIFIER: US 4790225 A

**** See image for Certificate of Correction ****

TITLE: Dispenser of discrete cable ties provided on a continuous ribbon of cable ties

Full	Title	Citation	Front	Review	Classification	Date	Reference	Sequences	Attachments	Claims	KWIC	Draw. De
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☐ 7. Document ID: US 4498506 A

L6: Entry 7 of 8

File: USPT

Feb 12, 1985

US-PAT-NO: 4498506

DOCUMENT-IDENTIFIER: US 4498506 A

TITLE: Tool for the automatic installation of discrete cable ties provided on a continuous ribbon of cable ties

Full	Title	Citation	Front	Review	Classification	Date	Reference	Sequences	Attachments	Claims	KWIC	Draw. De
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☐ 8. Document ID: US 20050137774 A1

L6: Entry 8 of 8

File: DWPI

Jun 23, 2005

DERWENT-ACC-NO: 2005-495587

DERWENT-WEEK: 200550

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TITLE: Sensing system for vehicle, has controller coupled to vision sensor which generates safety system signal in response to coordinates and at least one object detection signal

Full	Title	Citation	Front	Review	Classification	Date	Reference	Sequences	Attachments	Claims	KWIC	Draw. De
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L2: Entry 1 of 1

File: PGPB

Jun 23, 2005

DOCUMENT-IDENTIFIER: US 20050137774 A1TITLE: SINGLE VISION SENSOR OBJECT DETECTION SYSTEMAbstract Paragraph:

A sensing system (10) for a vehicle (12) includes a single vision sensor (14) that has a position on the vehicle (12). The single vision sensor (14) detects an object (40) and generates an object detection signal. A controller (16) is coupled to the vision sensor (14) and generates a safety system signal in response to the position of the vision sensor (14) and the object detection signal.

Pre-Grant Publication (PGPub) Document Number:
20050137774

Summary of Invention Paragraph:

[0001] The present invention relates to vehicle sensing systems. More particularly, the present invention relates to a method and system for performing object detection utilizing a single vision sensor.

Summary of Invention Paragraph:

[0011] The present invention provides a method and system for performing object detection and safety system operations within a vehicle. A sensing system for a vehicle is provided and includes a single vision sensor that has a position on the vehicle. The vision sensor detects an object and generates an object detection signal. A controller is coupled to the vision sensor and generates a safety system signal in response to the position of the vision sensor and the object detection signal.

Summary of Invention Paragraph:

[0012] The embodiments of the present invention provide several advantages. One of several of these advantages is the provision of a sensing system that is capable of determining object parameters relative to a host vehicle through use of a single vision sensor. In so doing, the present invention minimizes the number of sensors and related system components needed to perform multiple safety system operations. The present invention is capable of performing the safety system operations that are traditionally performed through use of multiple vision sensors.

Summary of Invention Paragraph:

[0013] Another advantage of the present invention is that it provides a sensing system that utilizes a single vision sensor, but provides accurate measurements for improved sensing system performance.

Detail Description Paragraph:

[0028] Referring now to FIG. 1, a block diagrammatic view of a safety system 10 for a vehicle 12 in accordance with an embodiment of the present invention is shown. The safety system 10 may perform as a sensing system, an adaptive cruise control system, a countermeasure system, or other safety system known in the art. The safety system 10 includes a single vision sensor 14 that has an associated position on the vehicle 12. The vision sensor 14 detects objects within proximity of the

vehicle 12. The vision sensor 14 is coupled to a controller 16, which determines object related parameters in response to the position of and signals received from the vision sensor 14. The controller 16 in response to the object parameters also performs various other safety system operations or tasks.

Detail Description Paragraph:

[0059] The present invention provides an accurate safety system for a vehicle that is capable of determining object parameters, such as object range and range rate, utilizing a single vision sensor. The present invention in utilizing a single vision sensor minimizes the number of sensors and sensing system components within a vehicle, minimizes sensing system complexity, and minimizes manufacturing and maintenance costs involved therein.

CLAIMS:

1. A sensing system for a vehicle comprising: a single vision sensor having a position with coordinates on the vehicle, detecting at least one object, and generating at least one object detection signal; and a controller coupled to said vision sensor and generating a safety system signal in response to said coordinates and said at least one object detection signal.
2. A system as in claim 1 wherein said single vision sensor is a single two-dimensional vision sensor.
3. A system as in claim 1 wherein said single vision sensor is a vision sensor selected from one of a camera, a charged coupled device, an infrared detector, a sensor having at least one photodiode, and a complementary metal-oxide semiconductor.
5. A system as in claim 1 wherein said controller determines position of said single vision sensor relative to a predetermined reference on the vehicle.
6. A system as in claim 1 wherein said controller determines position of said single vision sensor relative to a hoodline of the vehicle.
9. A method of performing safety system operations within a vehicle comprising: determining coordinates of only a single vision sensor on the vehicle; detecting at least one object with said single vision sensor and generating at least one object detection signal; and generating a safety system signal in response to said determined coordinates and said at least one object detection signal.
10. A method as in claim 9 wherein determining position of a single vision sensor comprises: determining distance between the single vision sensor and a reference on the vehicle; and determining relative vertical positioning of said single vision sensor relative to said reference.
19. A method as in claim 9 further comprising determining orientation of said single vision sensor and generating said safety system signal in response to said orientation.
20. An adaptive cruise control system for a vehicle comprising: a single vision sensor having a position with coordinates on the vehicle, detecting at least one object, and generating at least one object detection signal; and a controller coupled to said vision sensor, determining size and up-angle of said at least one object in response to said coordinates and said at least one object detection signal, and in response thereto determining range of said at least one object, wherein said controller reduces speed of the vehicle in response to said range.

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File: PGPB

Apr 7, 2005

DOCUMENT-IDENTIFIER: US 20050073396 A1
TITLE: MULTIPURPOSE VISION SENSOR SYSTEM

Abstract Paragraph:

A multipurpose sensing system (10) for a vehicle (12) includes an optic (14) that is directed at multiple viewing areas (18). A vision sensor (16) is coupled to the optic (14) and generates multiple object detection signals corresponding to the viewing areas (18). A controller (22) is coupled to the vision sensor (16) and generates multiple safety system signals in response to the object detection signals.

Application Filing Date:

20031002

Summary of Invention Paragraph:

[0001] The present invention relates to vehicle sensing systems. More particularly, the present invention relates to a method and system for performing multiple sensing system operations utilizing a single vision sensor.

Summary of Invention Paragraph:

[0010] The present invention provides a method and system for performing multiple sensing system tasks or operations. A multipurpose sensing system for a vehicle is provided and includes an optic that is directed at multiple viewing areas. A vision sensor is coupled to the optic and generates multiple object detection signals corresponding to the viewing areas. A controller is coupled to the vision sensor and generates multiple safety system signals in response to the object detection signals.

Detail Description Paragraph:

[0028] The vision sensor 16 may be a camera, a charged-coupled device, an infrared detector, a series of photodiodes, or other vision sensor known in the art. The vision sensor 16 may be located in various locations on the vehicle 12.

Detail Description Paragraph:

[0040] The indicator 26 is used to signal or indicate a safety system signal, which may include a warning signal, a collision-warning signal, a countermeasure signal, or an object identification signal in response to the object detection signals. The indicator 26 may include a video system, an audio system, an LED, a light, a global positioning system, a heads-up display, a headlight, a taillight, a display system, a telematic system, or other indicator known in the art. The indicator 26 may supply warning signals, collision-related information, lane departure and lane-keeping information, external-warning signals to objects or pedestrians located outside of the vehicle 12, or other pre and post collision information.

Detail Description Paragraph:

[0041] The multipurpose system 10 may be located in various locations in the vehicle 12. The multipurpose system 10 may be located within an overhead console 38, near any vehicle window 32, near a vehicle bumper 40, internal to or external from a vehicle cabin 42, or in various other locations known in the art.

Detail Description Paragraph:

[0043] In the embodiment of FIG. 3, the first viewing area 60" corresponds with the viewing angle of a reflective device 66. The lower portion 56 is directed at the reflective device 66. The viewing area 60" has a viewing boundary represented by dashed lines 70, which may vary depending upon the application, type of reflective device, mounting locations and relative arrangements of sensing system components, and other viewing angle factors known in the art. In an embodiment of the present invention, the viewing angle 68 is large enough to cover both driver and passenger seating areas of the vehicle 12.

Detail Description Paragraph:

[0050] In step 106, the controller 22 generates multiple safety system signals in response to the object detection signals. The safety system signals may include not only countermeasures related signals, as stated above, but may also include signals related to other sensing system controls, some of which are also stated above.

Detail Description Paragraph:

[0051] In step 108, the controller 22 may determine occupant characteristics in response to the object detection signals. In determining occupant characteristics the controller 22 may also determine whether a child safety seat is located within a vehicle seat of the viewing area 60". Step 108 may be performed simultaneously with step 106, whereby, the controller 22 generates or modifies safety system signals in response to the determined occupant characteristics.

Detail Description Paragraph:

[0052] In step 110, the controller 22 may perform multiple sensing system operations in response to the safety system signals. The controller 22 may perform a countermeasure operation, a windshield clearing operation, an adaptive cruise control operation, or any of the other above-mentioned or known in the art sensing system operation in response to the safety system signals. For example, the vision sensor 16 may detect a moisture level on the windshield 32 to be above a predetermined level and in response thereto the controller 22 may activate or increase speed of the wiper system 34. As another example, the vision sensor 16 may detect an occupant that is small in size or a child safety seat within a seat system and decelerate or prevent activation of an air bag near the occupant or safety seat.

Detail Description Paragraph:

[0054] The present invention provides a multipurpose sensing system that is capable of monitoring multiple viewing areas using a single vision sensor and controller. The present invention in utilizing a single vision sensor and controller minimizes the number of sensors and sensing system components within a vehicle, sensing system complexity, and manufacturing and maintenance costs involved therein.

CLAIMS:

1. A multipurpose sensing system for a vehicle comprising: at least one optic directed at a plurality of viewing areas; a single vision sensor coupled to said at least one optic and generating a plurality of object detection signals corresponding to said plurality of viewing areas; and a controller coupled to said vision sensor and generating a plurality of safety system signals in response to said plurality of object detection signals.
2. A system as in claim 1 wherein said vision sensor generates a first object detection signal and a second object detection signal and wherein said controller generates a first safety system signal in response to said first object detection signal and a second safety system signal in response to said second object detection signal.
16. A method of performing a plurality of sensing system operations within a

vehicle comprising: monitoring a plurality of viewing areas; generating a plurality of object detection signals from a single vision sensor corresponding to said plurality of viewing areas; generating a plurality of safety system signals in response to said plurality of object detection signals; and performing the plurality of sensing system operations in response to said plurality of safety system signals.

20. A multipurpose sensing system for a vehicle comprising: a multi-focal lens having a first focal point corresponding to a first viewing area and a second focal point corresponding to a second viewing area; a reflective device directed at said second viewing area; a vision sensor coupled to said bi-focal lens and generating a first object detection signal with respect to said first viewing area and a second object detection signal with respect to said second viewing area as is reflected from said reflective device; and a controller coupled to said vision sensor and generating a first safety system signal in response to said first object detection signal and a second safety system signal in response to said second object detection signal.

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Jan 27, 2005

DOCUMENT-IDENTIFIER: US 20050017857 A1

TITLE: VISION-BASED METHOD AND SYSTEM FOR AUTOMOTIVE PARKING AID, REVERSING AID,
AND PRE-COLLISION SENSING APPLICATIONAbstract Paragraph:

A vision-based object detection decision-making system (10) for a vehicle (12) includes multiple vision sensing systems (14) that have vision receivers (20) and that generate an object detection signal. A controller (16) includes a plurality of sensing system aid modules (18) that correspond to each of the vision sensing systems (14). The controller (16) operates the sensing system aid modules (18) in response to a vehicle parameter and generates a safety system signal in response to the object detection signal. The sensing system aid modules (18) have associated operating modes and operate the vision sensing systems (14) in the operating modes in response to the vehicle parameter.

Application Filing Date:

20030725

Summary of Invention Paragraph:

[0012] The present invention provides a system and method of performing object detection within an automotive vehicle utilizing vision-based technologies. A vision-based object detection system for a vehicle is provided. The vision-based system includes multiple vision sensing systems that have a vision receiver and generates an object detection signal. A controller includes a plurality of sensing system aid modules that correspond to each of the vision sensing systems. The controller operates the sensing system aid modules in response to a vehicle parameter and generates a safety system signal in response to the object detection signal. The sensing system aid modules have associated operating modes and operate the vision sensing systems in the operating modes in response to the vehicle parameter.

Summary of Invention Paragraph:

[0013] One of several advantages of the present invention is that it provides a single vision-based object detection system that is capable of operating in multiple sensing system modes and performing multiple collision avoidance, countermeasure, and comfort and convenience type tasks.

Detail Description Paragraph:

[0042] The controller 16 may operate the system 10 in any or all of the above stated modes simultaneously. The controller 16 to obtain an appropriate operating performance for a selected operating mode, may adjust accuracy measurements corresponding with object relative position and velocity, as well as adjusting update rate and field of view (FOV). In adjusting FOV the controller 16 may transition between different lenses, transition between different cameras, may generate a split screen, or perform some other FOV adjusting technique known in the art. A split screen (not shown), for example, may be utilized to monitor both directly in front of the vehicle 12 and areas farther from the vehicle 12. A first half of the screen may have a first FOV and a second half of the screen may have a second FOV. The controller 16 may operate one vision receiver in a parking-aid mode having a first resolution and simultaneously operate a second vision receiver in a

pre-collision mode with a second resolution that is different from that of the first resolution, in order to compensate or adjust for different desired FOVs.

Detail Description Paragraph:

[0048] Indicator 32 is used to signal or indicate a safety system signal, which may include a warning signal, a collision-warning signal, a countermeasure signal, or an object identification signal in response to the object detection signals. The indicator 32 may include a video system, an audio system, an LED, a light, global positioning system, a heads-up display, a headlight, a taillight, a display system, a telematic system or other indicator. The indicator 32 may supply warning signals, collision-related information, lane departure and lane-keeping information, external-warning signals to objects or pedestrians located outside of the vehicle 12, or other pre and post collision information.

Detail Description Paragraph:

[0070] The present invention provides a vision-based object detection system that has a single controller that is capable of operating in multiple sensing system modes. The present invention simplifies costs of using multiple vision-based systems through use of a single controller having multiple sensing system aid modules.

CLAIMS:

1. A vision-based object detection system for a vehicle comprising: a plurality of vision sensing systems having at least one vision receiver and generating an object detection signal; and a controller comprising a plurality of sensing system aid modules corresponding to each of said plurality of vision sensing systems, operating at least one of said plurality of sensing system aid modules in response to at least one vehicle parameter, and generating at least one safety system signal in response to said object detection signal; said plurality of sensing system aid modules have at least one associated operating mode and operates at least one of said plurality of vision sensing systems in said at least one operating mode in response to said at least one vehicle parameter.

13. A system as in claim 1 further comprising an indicator electrically coupled to said controller and wherein said controller indicates said safety system signal via said indicator.

14. A method of performing a plurality of sensing system aids for a vehicle comprising: generating an object detection signal via a plurality of vision sensing systems; operating a plurality of sensing system aid modules corresponding with each of said plurality of vision sensing systems via a single controller; and generating at least one safety system signal in response to said object detection signal.

20. A vision-based object detection system for a vehicle comprising: a transmission gear sensor generating a transmission gear signal; a plurality of vision sensing systems having at least one vision receiver, generating an object detection signal, and operating simultaneously in a plurality of modes selected from a reversing-aid mode, a parkingaid mode, a pre-collision sensing mode, an adaptive cruise control mode, a lane departure aid mode, and a lane-keeping aid mode; and a single vision processor comprising a plurality of sensing system aid modules corresponding with each of said plurality of vision sensing systems, operating said plurality of sensing system aid modules in response to said transmission gear signal, and generating at least one warning signal or one countermeasure signal in response to said object detection signal.

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